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Date: August 31, 2005

To: Examiner: Matthew J. Song  
Art Unit: 1722

Fax No.: (571) 273-8300

From: Kevin C. Brown

Subject: U.S. Application Ser. No. 09/928,523

Filed: August 13, 2001

Conf. No.: 8032

Title: AN APPARATUS FOR FABRICATING A III-V NITRIDE FILM AND A  
METHOD FOR FABRICATING THE SAME

Our Ref.: 782\_181

You should receive 11 page(s) including this cover sheet. If you do not receive all pages, please call (315) 233-8300.**CERTIFICATION OF FACSIMILE TRANSMISSION**

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| • Transmittal (in duplicate)  | _ 2 _ pages |
| • Request for Reconsideration | _ 8 _ pages |
| • This Cover Sheet            | _ 1 _ pages |



Janet M. Stevens  
Total Pages 11

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BURR & BROWN

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**TRANSMITTAL FORM**

(Provisions of 37 CFR 1.136 Apply)

|                    |   |                     |                 |
|--------------------|---|---------------------|-----------------|
| Application Number | 09/928,523  | Filing Date         | August 13, 2001 |
| Group Art Unit     | 1722  | Examiner Name       | Matthew J. Song |
| Confirmation No.   | 8032  | Attorney Docket No. | 782_181         |
| Inventor(s)        | Tomohiko SHIBATA, Keiichiro ASAII, and Mitsuhiro TANAKA                                 |                     |                 |
| Invention:         | AN APPARATUS FOR FABRICATING A III-V NITRIDE FILM AND A METHOD FOR FABRICATING THE SAME |                     |                 |

Transmitted herewith is a Request for Reconsideration in the above-identified application. The fee has been calculated as follows:

**CLAIMS AS AMENDED**

| (1)  | (2)<br>Claims Remaining<br>After Amendment | (3)   | (4)<br>Highest Number<br>Previously Paid | (5)<br>No. of Extra Claims<br>Present | (6)<br>Rate<br>(Large Entity) | (7)<br>Additional<br>Fee |
|--|--|-------|--|---------------------------------------|-------------------------------|--------------------------|
| TOTAL CLAIMS                                   | 4  | MINUS | 20                                       | 0                                     | \$50.00                       | \$00.00                  |
| INDEP. CLAIMS                                  | 1  | MINUS | 3  | 0                                     | \$200.00                      | \$00.00                  |
| <b>TOTAL ADDITIONAL FEE FOR THIS AMENDMENT</b> |  |       |  |                                       |                               | <b>\$00.00</b>           |

**EXTENSION OF TERM**

- Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition for extension of time.
- This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application. The requested extension and appropriate non-small entity fee are as follows:
- |  |            |
|--|------------|
| <input type="checkbox"/> One Month (37 CFR 1.17(a)(1)) .....   | \$120.00   |
| <input type="checkbox"/> Two Month (37 CFR 1.17(a)(2)) .....   | \$450.00   |
| <input type="checkbox"/> Three Month (37 CFR 1.17(a)(3)) ..... | \$1,020.00 |

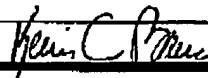
**TOTAL FEES DUE**

- Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee amount is reduced by one-half, and the resulting fee is:

**FEES PAYMENT**

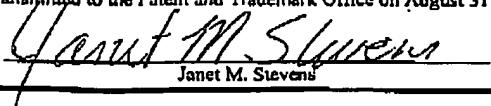
- No additional fee is required.  A check in the amount of \$\_\_\_\_\_ is enclosed.
- Charge Deposit Account 50-1446 in the amount of \$. Enclosed is a duplicate copy of this sheet.
- Please charge any fees which may be required, or credit any overpayment, to Deposit Account 50-1446.

Submitted By:

|                   |   |           |                |              |                 |
|-------------------|---|-----------|----------------|--------------|-----------------|
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|                   |   | Telephone | (315) 233-8300 | Facsimile    | (315) 233-8320  |
| Signature         |  |           |                | Date         | August 31, 2005 |

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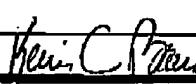
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Janet M. Stevens

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AUG 31 2005

Practitioner's Docket No.: 782\_181

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Tomohiko SHIBATA, Keiichiro ASAI, and Mitsuhiro TANAKA

Ser. No.: 09/928,523

Group Art Unit: 1722

Filed: August 13, 2001

Examiner: Matthew J. Song

Confirmation No.: 8032

For: AN APPARATUS FOR FABRICATING A III-V NITRIDE FILM AND A METHOD FOR FABRICATING THE SAME

Mail Stop Amendment  
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Alexandria, VA 22313-1450

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| <i>Janet M. Stevens</i><br>Janet M. Stevens  |

REQUEST FOR RECONSIDERATION

Sir:

The following remarks are in response to the Office Action mailed June 14, 2005.

The Applicants thank Examiner Song for the courtesies extended during a telephone interview conducted on August 30, 2005. The substance of the discussion during that interview is incorporated in the following remarks.

Claims 8-11 were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 6,533,874 (Vaudo '874) in view of Japanese 2-34592 (JP '592) and U.S. Patent No. 5,728,940 (Kim '940).

The present invention relates to an apparatus which comprises an inner reactor, an outer reactor, an evacuation system, a gas-supplying means, a heater and a gas leak-detecting means. The inner reactor and outer reactor are spaced from one another and define a space

therebetween. The evacuation system is in communication with the space. The gas-supplying means introduces chloride-based gas, ammonia gas and carrier gas into the inner reactor. The heater heats the interior of the inner reactor. The gas leak-detecting means comprises a gas concentration sensor to detect gas leaks between the inner reactor and the outer reactor.

The Office Action contains assertions that JP '592 discloses a double reactor structure because JP '592 discloses a quartz liner 18 spaced from a quartz ampoule 11.

Referring to Fig. 1 and the related description in JP '592, the quartz ampoule 11 is disposed in the quartz liner 18. The quartz liner 18 and the quartz ampoule 11 are surrounded by electric furnaces 16 and 17. Since JP '592 is directed to growing a semiconductor compound single crystal with higher dissociation pressure such as InP, it is required that the quartz ampoule 11 be sealed in vacuum (see page 5, lines 16-17) such that raw materials such as P in the quartz ampoule 11 can be controlled without influence by the external atmosphere. Since only non-corrosive raw materials such as P are employed, the quartz ampoule 11 may not be corroded. Moreover, since the quartz liner 18 has a supplemental thermal insulative substance 27, it is apparent that the quartz liner 18 stabilizes the temperature distribution in the quartz ampoule 11 in addition to supporting the quartz ampoule 11.

In contrast, the present invention is directed to growing a group III semiconductor nitride using a Hydride Vapor Phase Epitaxy (HVPE) method. In this case, as is apparent from Fig. 4 and the related description, the raw material gases such as chloride-based gas and NH<sub>3</sub> are supplied onto the substrate 33 and are continuously passed through the inner reactor 31. Therefore, the inner reactor 31 is not sealed in vacuum. Moreover, according to the present invention, since the corrosive raw material gas such as HCl is employed, the inner reactor 31 may be corroded even though the inner reactor 31 is made of corrosion-resistant

material such as quartz, because the growing process is carried out at a temperature of, e.g., 900°C, or higher.

In the present invention, the outer reactor 32 covers the inner reactor 31, and therefore the outer reactor 32 can prevent leakage of raw material gases, typically the corrosive raw material gas, even if the inner reactor 31 is destroyed, e.g., by corrosive raw material gas. Then, since the space between the inner reactor 31 and the outer reactor 32 is maintained in vacuum by the evacuation system 45, if the raw material gases leak from the inner reactor 31, e.g., as a result of destruction, the leaked raw material gases can be detected in the space by the sensor 50, because the leaked raw material gases may exist in such space. In this case, since the space is maintained in vacuum, the leaked raw material gases can be detected at high sensitivity.

Accordingly, the respective constructions and functions of the components in JP '592 differ markedly from the double reactor structure according to the present invention.

In addition, Vaudo '874 discloses using a sapphire-based or carbon-based reactor instead of a conventional quartz reactor in the formation of an Al-based semiconductor compound using HVPE (see column 11, lines 40-67). In the present invention, however, since the double reactor structure is employed, the inner reactor can be made of quartz because even if the inner reactor is damaged and leaks raw material gases, such gases can be prevented from leaking by the outer reactor.

The June 14, 2005 Office Action characterizes Vaudo '874 as disclosing an apparatus for growing a (Ga, Al, In) nitride on a substrate using HVPE, noting that Vaudo '874 discloses an HVPE reactor 52 having feed ports 72, 74, 76 and 78, and that the reactor is a multi-zoned hot-wall reactor in which temperatures of 1000-1400°C are employed.

The Office Action contains acknowledgments that:

- Vaudo '874 does not disclose an inner reactor and an outer reactor spaced from one another; and
- Vaudo '874 does not disclose a gas leak-detecting means and an evacuation system in communication with a space between an inner reactor and an outer reactor.

As described in the Office Action and as expressed by Examiner Song in the August 31, 2005 interview, it is the position of the U.S. PTO that it would have been obvious, in view of JP '592 and Kim '940, to one of ordinary skill in the art to have modified the reactor disclosed in Vaudo '874 (see Fig. 2) to add an outer reactor surrounding and spaced from the HVPE reactor, to add an evacuation system in communication with the space (between the added outer reactor and the HVPE reactor) and to add a gas leak-detecting means with a gas concentration sensor to detect gas leaks between the added outer reactor and the HVPE reactor. For the reasons discussed below, it is respectfully pointed out that a person of skill in the art who had reviewed the applied references would not have envisioned the combination of structures relied on by the Examiner, and that the present rejection results only from using the present invention as a guide to select disclosure of various structures in the applied references and mentally assemble them in such a way that the modified structure would fall within the scope of the present claims. Such an analysis is not a proper basis for sustaining an obviousness rejection.

JP '592 discloses a method for growing a compound semiconductor single crystal, e.g., InP. JP '592 discloses installing a seed 15 in the ampoule 11 which contains phosphorus 12 and a boat 13 with indium 14, and then (after the seed has been installed) placing the ampoule 11 within the electric furnaces 16 and 17 (see Fig. 1).

The Office Action includes a statement that JP '592 discloses a quartz liner 18 spaced apart from a quartz ampoule 11 and that "this reads on applicant's inner and outer reactor being spaced from one another . . ." (Office Action, page 4, lines 1-3). The Office Action further contains an assertion that it would have been obvious to modify Vaudo '874 with the quartz liner of JP '592 "because a liner tube between a reactor and a heater ensures uniform heating of the reactor." (Office Action, page 4, lines 4-6).

During the August 30, 2005 interview, the Applicants' representative pointed out that the HVPE reactor 52 of Vaudo '874 includes feed ports 72, 74, 76 and 78, and an exhaust port 62, whereas the quartz ampoule 11 of JP '592 is sealed in vacuum (after the phosphorus 12, the boat 13 with indium 14 and the seed 15 have been placed within the ampoule 11). Accordingly, modifying the HVPE reactor of Vaudo '874 by replacing it with the ampoule 11 and the liner tube 18 of JP '592 would not have been obvious, because such a substitution would not permit the reactor of Vaudo '874 to function in the manner as disclosed in Vaudo '874.

Examiner Song stated that the U.S. PTO's position is that it would have been obvious to add a liner tube, analogous to the liner tube 18 in JP '592, surrounding and spaced from the HVPE reactor 52 of Vaudo '874. The Office Action asserts that the motivation to make such a modification would have been to "ensure uniform heating of the reactor." (Office Action, page 4, lines 5-6).

During the August 30, 2005 interview, the Applicants' representative asked Examiner Song to specify the disclosure on which he is relying in the statement that adding a liner tube surrounding and spaced from the HVPE reactor of Vaudo '874 would ensure uniform heating. Examiner Song responded by stating that he is relying on U.S. Patent No. 4,382,776 (Kawase '776), a reference which is not included in the present rejection, as the basis for this assertion.

Kawase '776 discloses that quartz tubes have been used for high-temperature processing, such as oxidation, evaporation, chemical vapor deposition, diffusion of impurities, etc., and that it has been necessary to make a relatively large allowance for the gap between the outer surface of the tube and the furnace. According to Kawase '776, unevenness on the surface of the tube results in a so-called lens effect when ultra-red rays irradiate, i.e., an extraordinarily high temperature appears in a spot within the processing tube, and that in such situations, a liner tube must be provided in the gap between the processing tube and the heater, so as to ensure uniform heating of the tube (Kawase '776, column 1, lines 27-38).

The Office Action, however, contains no allegation, nor does there appear to be any basis for any allegation, that Vaudo '874 discloses, expressly or inherently, any need for making heating of the HVPE reactor 52 more uniform. Moreover, the Office Action contains no analysis whatsoever as to any similarity between the HVPE reactor 52 of Vaudo '874 and the structures disclosed in Kawase '776 so as to establish that a person of skill in the art would have any expectation that a liner tube as disclosed in Kawase '776 would somehow cause the heating within the HVPE reactor 52 to be more uniform, let alone that a liner tube 18 having tube and heat insulators 23 at opposite ends as disclosed in JP '592 would somehow cause the heating within the HVPE reactor 52 to be more uniform. It is respectfully noted that JP '592 contains no suggestion whatsoever that the quartz liner tube 18 disclosed therein has any effect on the uniformity of heating within various sections of the ampoule 11 (i.e., within the various sections by which JP '592 establishes a temperature profile for inducing the crystal to grow (JP '592, translation, page 6, lines 8-11)).

The Office Action further refers to disclosure in Kim '940 of a pump 15 connected to a detector 11, the pump suctioning leakage gas through inflow apertures 12a, 12b and 12c (see Fig. 1). The Office Action contains an assertion that it would have been obvious in view

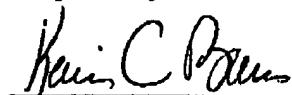
of Kim '940 to provide an evacuation system in communication with a space between the HVPE reactor 52 of Vaudo '874 and a quartz liner 18 as disclosed in JP '592 (inserted in view of the heat conduction properties of an apparatus disclosed in Kawase '776) and to provide a gas leak-detecting means with a gas concentration sensor to detect gas leaks between the HVPE reactor 52 of Vaudo '874 and a quartz liner 18 as disclosed in JP '592 (inserted in view of the heat conduction properties of an apparatus disclosed in Kawase '776). First, as noted above, there is no disclosure in Vaudo '874, JP '592 or Kawase '776 which would indicate to a person of ordinary skill in the art that positioning a quartz liner tube 18 as disclosed in JP '592 outside of and spaced from the HVPE reactor 52 of Vaudo '874 would make heating within the HVPE reactor 52 more uniform, or that Vaudo '874 has any desire or need for making such heating more uniform. Second, Kim '940 merely provides a system in which a pump is provided for conveying gas from a location where it is desired to detect leakage (e.g., from the gas injection portion of a diffusion furnace, a box of a vapor generator or a utility box) into a detector 11 which determines whether the amount of leakage gas is over a predetermined value. Kim '940 does not provide a system which includes both an evacuation system in communication with a space and, as a separate structural element, a gas leak-detecting means with a gas concentration sensor to detect gas leaks in such space, let alone such a system in which the space is positioned between an inner reactor and an outer reactor.

For all of the foregoing reasons, it is respectfully submitted that the present rejection was assembled only through an accumulation of structural elements disclosed in four prior art references, none of which disclose or suggest the relative positioning and functioning of those elements as recited in the present claims. Accordingly, it is respectfully requested that the U.S. PTO reconsider and withdraw this rejection.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,



\_\_\_\_\_  
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